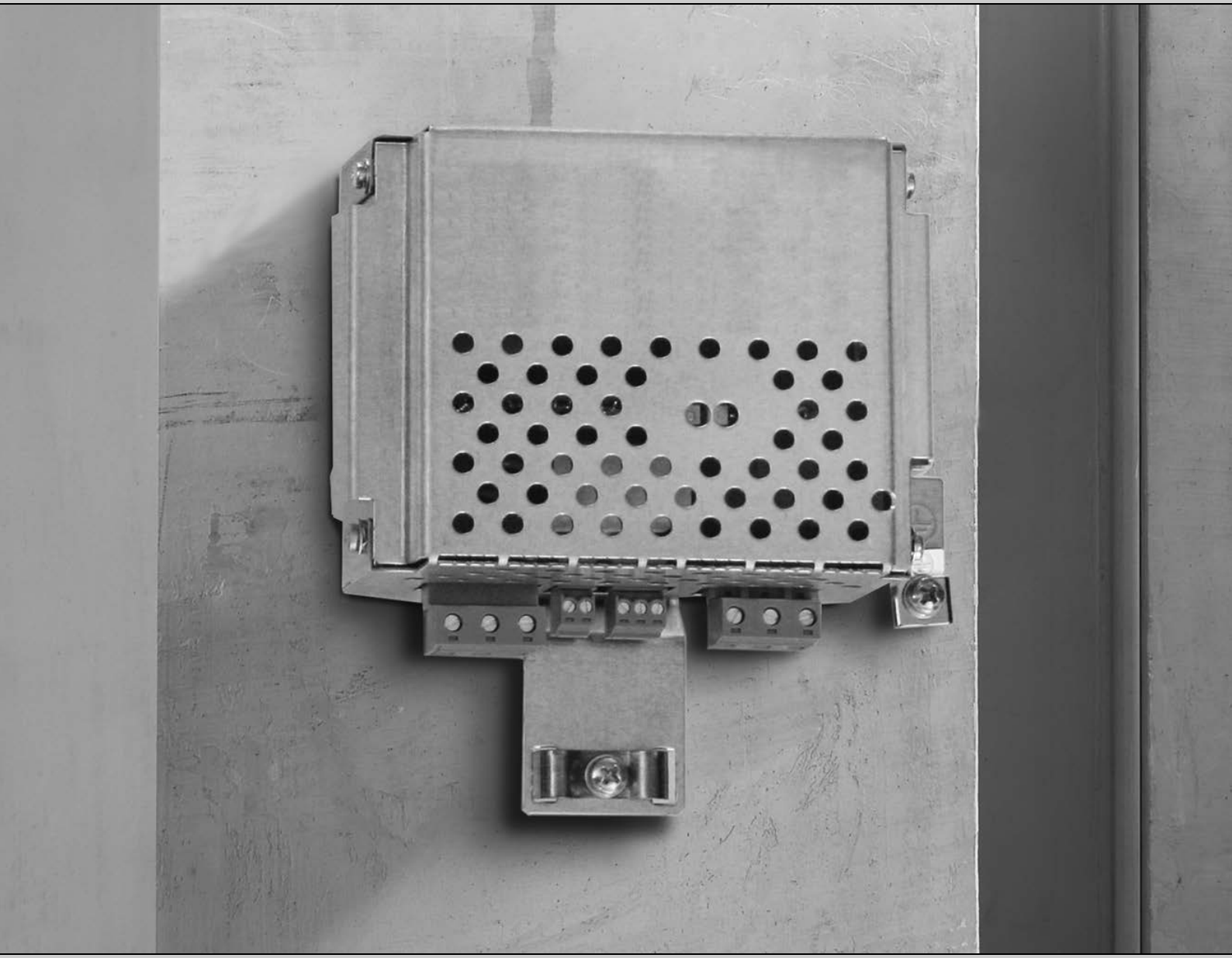
SEW EURODRIVE

Operating Instructions



Safety-Related BST Brake Module
for Control Cabinet Installation

Edition 10/2011

19357214 / EN

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1 General Information

1.1 How to use this documentation

The documentation is part of the product and contains important information. The documentation is for everyone who works with this product.

The documentation must be accessible and legible. Make sure that persons responsible for the system and its operation, as well as persons who work independently with the software and the connected units from SEW-EURODRIVE, have read through the documentation carefully and understood it. If you are unclear about any of the information in this documentation, or if you require further information, contact SEW-EURODRIVE.

1.2 Structure of the safety notes

1.2.1 Meaning of the signal words

The following table shows the grading and meaning of the signal words for safety notes, notes on potential risks of damage to property, and other notes.

Signal word	Meaning	Consequences if disregarded
⚠ **DANGER**	Imminent danger	Severe or fatal injuries
⚠ **WARNING**	Possible dangerous situation	Severe or fatal injuries
⚠ **CAUTION**	Possible dangerous situation	Minor injuries
NOTICE	Possible damage to property	Damage to the drive system or its environment
INFORMATION	Useful information or tip: Simplifies the handling of the drive system.	

1.2.2 Structure of the section-related safety notes

Section safety notes do not apply to a specific action, but to several actions pertaining to one subject. The used symbols indicate either a general or a specific hazard.

This is the formal structure of a section safety note:

⚠ SIGNAL WORD

Type and source of danger.

Possible consequence(s) if disregarded.

- Measure(s) to prevent the danger.

1.2.3 Structure of the embedded safety notes

Embedded safety notes are directly integrated in the instructions just before the description of the dangerous action.

This is the formal structure of an embedded safety note:

- ⚠ **SIGNAL WORD** Nature and source of hazard.

  Possible consequence(s) if disregarded.

  – Measure(s) to prevent the danger.

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1.3 Right to claim under warranty

A requirement of fault-free operation and fulfillment of any rights to claim under limited warranty is that you adhere to the information in the documentation at hand. Therefore, read the documentation before you start working with the software and the connected units from SEW-EURODRIVE.

Make sure that the documentation is available to persons responsible for the machinery and its operation as well as to persons who work independently on the devices. Also ensure that the documentation is legible.

1.4 Exclusion of liability

You must adhere to this documentation and the documentation of the connected devices from SEW-EURODRIVE to ensure safe operation and to achieve the specified product characteristics and performance features.

SEW-EURODRIVE assumes no liability for injury to persons or damage to equipment or property resulting from non-observance of the documentation. In such cases, any liability for defects is excluded.

1.5 Copyright

© 2011 – SEW-EURODRIVE. All rights reserved.

Unauthorized duplication, modification, distribution or any other use of the whole or any part of this documentation is strictly prohibited.

1.6 Product names and trademarks

All brands and product names in this documentation are trademarks or registered trademarks of their respective titleholders.

1.7 Applicable documentation

Observe the following applicable documents:

- Certificates and characteristic safety values

Make sure you always use the latest documentation and software version.

Our documentation is available in various languages for download from the SEW homepage. If you are unclear about any of the information in this documentation, or if you require further information, please contact SEW-EURODRIVE.

If required, you can order printed copies of the documentation from SEW-EURODRIVE.

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2 Safety Notes

The following basic safety notes must be read carefully to prevent injury to persons and damage to property. The operator must ensure that the basic safety notes are read and adhered to. Make sure that persons responsible for the plant and its operation, as well as persons who work independently on the unit, have read through the operating instructions carefully and understood them. If you are unclear about any of the information in this documentation, or if you require further information, please contact SEW-EURODRIVE.

2.1 Preliminary information

This document contains safety-related conditions for the operation of the safety-relevant BST brake module with safe disconnection of the brake.

The classification to category 3 according to EN 954-1, or performance level d according to EN ISO 13849-1 applies to the control and not to the brake.

2.2 General information

Never install or start up damaged products. Submit a complaint to the shipping company immediately in the event of damage.

All work related to transportation, storage, setup/mounting, connection, startup, maintenance and repair may only be carried out by qualified personnel, in strict observance of:

- The relevant detailed operating instructions
- The warning and safety signs
- All other project planning documents, operating instructions and wiring diagrams related to the drive
- The specific regulations and requirements for the system
- The national/regional regulations governing safety and the prevention of accidents

The requirements for the safety switching device and the permitted circuit variants are specified in detail in section "Requirements for external safety switching devices" (page 16) and must be strictly observed.

The system/machine manufacturer must perform a system/machine-specific risk assessment. This is to take into account the safety-relevant BST brake module as well as the mechanical brake design.

Removing covers without authorization, improper use as well as incorrect installation or operation may result in severe injuries to persons or damage to property.

Refer to the documentation for additional information.

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2.3 Target group

Only qualified personnel is allowed to perform installation, startup, fault repair and servicing (observe IEC 60364 or CENELEC HD 384 or DIN VDE 0100 and IEC 60664 or DIN VDE 0110 as well as national accident prevention guidelines).

Qualified electricians in the context of these basic safety notes are persons familiar with installation, assembly, startup and operation of the product who possess the required qualifications.

Any activities regarding transportation, storage, operation, and disposal must be carried out by persons who have been instructed appropriately.

2.4 Designated use

The safety-relevant BST brake module is responsible for the power supply and control of disk brakes from SEW-EURODRIVE. For the permitted combination of safety-related BST brake module and SEW disk brake, refer to the section "Permitted unit combinations" in the "Safety-Relevant Conditions" chapter. The safety-relevant BST brake module is intended for industrial systems and may only be used in accordance with the information provided in SEW-EURODRIVE's technical documentation and the information given on the nameplate.

2.5 Transport

Inspect the shipment for any damage that may have occurred in transit as soon as you receive the delivery. Inform the shipping company immediately. It may be necessary to preclude startup.

2.6 Installation/assembly

Observe the notes in chapter "Mechanical Installation" (page 21).

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2.7 Startup/operation

- When the safety-related control voltage $V_{24\ V\ safe}$ / functional control voltage $V_{24\ V\ in}$ is disconnected, the DC link voltage $V_{DC\ link}$ is still present at the brake module.
- The safety concept is only suitable for performing mechanical work on the system/ machine components.
- All poles must be disconnected from the supply system when work is carried out on the electrical section of the system. Dangerous voltages may still be present for up to 10 minutes after disconnection from the power supply system.
- You have to take into account that, in case of a fault, the application time of the connected brake is longer, which means the drive might coast.
  - For maximum brake application times, refer to chapter "Technical Data" of the operating instructions for the BST and SEW disk brakes.
  - Note: If coasting to a halt results in application-dependent hazards, take additional protective measures (e.g. movable covers with closure), which cover the hazardeous area until persons are no longer in danger.
  - The additional protective covers must be designed and integrated to meet the requirements stipulated in EN ISO 12100:2010 and the requirements determined for the machine based on the risk assessment.
  - After activating the stop command, access to the machine must remain blocked until the drive has reached standstill, or the access time has to be determined to ensure that an adequate safety distance is maintained.
- The states of LED V1 and LED V2 must not be regarded as safety-relevant. The fact that the LED V1 and LED V2 are no longer illuminated does not indicate that the safety-relevant BST brake module is de-energized and the brake is applied. Even if LED V1 and LED V2 are not illuminated, DC link voltage $V_{DC\ link}$ might be present at the BST brake module.
- The safety-related BST brake module does not detect a mechanical fault (such as brake lining wear) of the disk brakes of SEW-EURODRIVE.

2.8 Inspection/maintenance

Observe the notes in chapter "Inspection/Maintenance" (page 28).

2.9 Disposal

Dispose the BST in accordance with the material structure and the regulations in force for instance as:

- Iron
- Copper
- Aluminum
- Plastic

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3 Integrated Safety Technology

The safety technology of the safety-related BST brake module described in this document has been developed and tested in accordance with the following safety requirements:

- Category 3 according to EN 954-1
- Performance level d according to EN ISO 13849-1

This was certified by TÜV Nord. A copy of the TÜV certificate can be obtained from SEW-EURODRIVE.

3.1 Safe condition

Safety-relevant use of the BST brake module means the **de-energized condition of the connected brake is defined as safe condition**. This is the basis of the safety concept.

3.2 Safety concept

- The safety-related BST brake module enables the connection of an external fail-safe safety switching device/safety controller. The safety switching device disconnects the safe control voltage $V_{24\ V\ safe}$ when a connected control device (e.g. emergency stop device) is activated.
- Disconnecting the safe control voltage $V_{24\ V\ safe}$ means the connected brake is disconnected from the power supply. The power supply required for releasing the connected brake is interrupted safely.
- Instead of separating the brake control galvanically from the power supply using contactors or switches, the disconnection procedure described here prevents the power semiconductors in the safety-related BST brake module from being activated, in this way ensuring safe disconnection. This means that all connected brakes are de-energized although the supply voltage is still present at the safety-related BST brake module.

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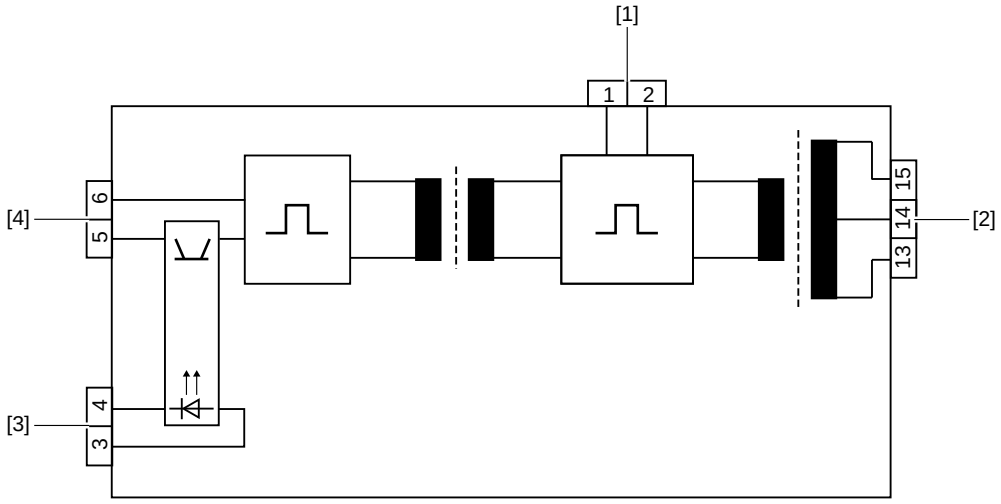
3.2.1 Block diagram BST



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[1] DC link voltage input $V_{DC\ link}$ (terminal 1/2)
[2] Brake output (terminals 13/14/15)
[3] Functional control voltage input $V_{24\ V\ in}$ (terminal 3/4)
[4] Safety-related control voltage input $V_{24\ V\ safe}$ (terminal 5/6)

3.3 Safety function

The following drive-related safety function can be used:

- **SBC** (Safe Brake Control according to IEC 61800-5-2)

  The SBC function safely de-energizes the connected brake by disconnecting the safety-related control voltage $V_{24\ V\ safe}$. The safety-related control voltage must be disconnected using a suitable external safety switching device/safety controller.

INFORMATION

Safety-related brake control must be carried out using the safety-related control voltage $V_{24\ V\ safe}$ (terminal 5/6) only.

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3.4 Restrictions

⚠ WARNING

Voltage is still present at the DC link connection of the frequency inverter even when disconnecting the safety-related control voltage $V_{24\ V\ safe}$ / functional control voltage $V_{24\ V\ in}$.

Severe or fatal injuries from electric shock.

- If work is carried out on the electrical section of the brake system, the supply voltage must be disconnected using an external maintenance switch.

INFORMATION

- The safety concept is only suitable for performing mechanical work on the system/ machine components.
- A system/machine-specific risk assessment must be carried out by the system/ machine manufacturer and be observed when using the drive system with BST.

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4 Safety-Relevant Conditions

The safety function of BST can only be used for safe operation of the system/machine if it is integrated correctly in an application-specific, higher-level safety function or safety system. It is essential that the system/machine manufacturer conducts a system/machine-specific risk assessment (e.g. according to EN ISO 12100) and validates the required safety conditions and functions prior to startup. The system/machine manufacturer and the operator are responsible for compliance of the system/machine with applicable safety regulations.

The following requirements are mandatory when installing and operating the BST brake module in safety-related applications.

The conditions are divided into the following sections:

- Approved device combinations
- Installation requirements (page 14)
- Requirements for the external safety controller (page 16)
- Startup requirements (page 17)
- Operation requirements (page 18)

4.1 Permitted unit combinations

The following BST unit types are permitted for safety-related applications:

Type designation	Part number	Approved SEW disk brakes
BST 0.6S-460V-00	0 829 971 4	All brake coils with a coil voltage of AC 460 V and a coil power ≤ 120 W. Several brake coils can be connected for redundant systems. In this case, the total power must not exceed 120 W.
BST 0.7S-400V-00	1 300 077 2	All brake coils with a coil voltage of AC 400 V and a coil power ≤ 120 W. Several brake coils can be connected for redundant systems. In this case, the total power must not exceed 120 W.
BST 1.2S-230V-00	1 300 133 7	All brake coils with a coil voltage of AC 230 V and a coil power ≤ 120 W. Several brake coils can be connected for redundant systems. In this case, the total power must not exceed 120 W.

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Only SEW disk brakes may be connected to the BST module.

Brake type[1]	Asynchronous motor type									
	DR.71	DR.80	DR.90	DR.100	DR.112	DR.132	DR.160	DR.180	DR.200	DR.225
BE05	x	x								
BE1	x	x	x							
BE2		x	x	x						
BE5			x	x	x	x				
BE11					x	x	x			
BE20							x	x		
BE30								x	x	x
BE32								x	x	x

1) Brakes of the type BM or BM(G) 05 – 30 can be combined.

Brake type[1]	Synchronous motor type		
	CMP.71	CMP.80	CMP.100
BY2	x		
BY4		x	
BY8			x

1) Brakes of the type B can be combined.

4.2 Requirements on the installation

The line between the safety switching device/safety controller and the safety-related BST brake module, terminal 5/6 ($V_{24\ V\ safe}$) is referred to as safety-related control line (for safe disconnection).

Observe the following requirements on the installation:

- Power lines and safety-related control lines have to be installed in separate cables.
- The total cable length between the safety switching device/safety controller and the safety-related BST brake module is limited to a maximum length of 100 m for EMC reasons.
- The total cable length between the safety-related BST brake module and the connected brake must not exceed 200 m.
- Wiring must comply with EN 60204-1.
- The installation space (control cabinet) must have at least degree of protection IP54.
- The safety-related control lines must be routed according to EMC guidelines and as follows:
  - Outside an electrical installation space: Shielded cables must be routed permanently (fixed) and protected against external damage, or other equivalent measures.
  - Individual conductors can be routed inside an electrical installation space. Observe the respective regulations governing the application.
  - It is essential that you apply the shielding at both ends on the housing.
- The safety-related control voltage $V_{24\ V\ safe}$ may not be used for feedback.

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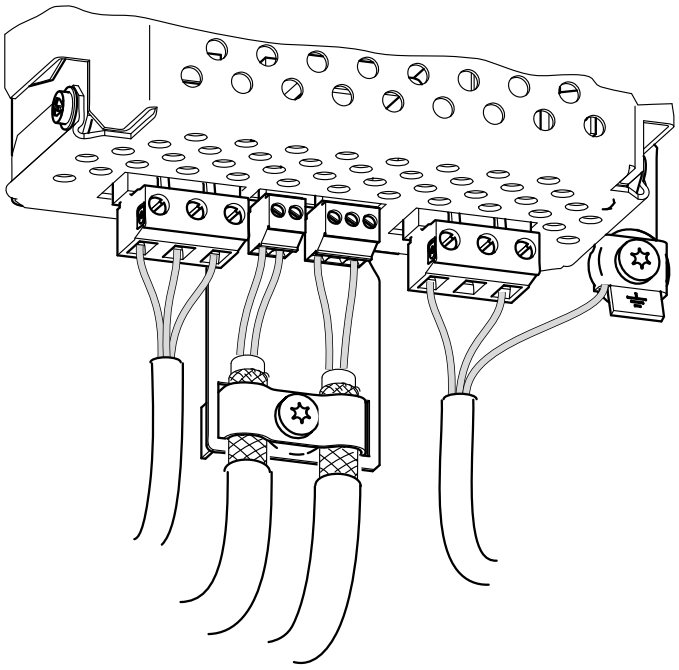
- You have to make sure that there is no transient coupling to the safety-related control voltage $V_{24\ V\ safe}$.
- Observe the values specified for safety components when designing the safety circuits.
- Use only voltage sources with safe disconnection (SELV/PELV) according to EN 60204-1 for any DC 24 V voltage supply (safety-related control voltage $V_{24\ V\ safe}$ and functional control voltage $V_{24\ V\ in}$) of the safety-related BST brake module.

  In case of a single fault, the voltage between the outputs or between any output and grounded parts must not exceed DC 60 V.
- Do not interconnect brake cables of several brake control systems.
- For disconnection of group drives, observe the switching capacity of the safety switching device and the maximum permitted voltage drop on the safety-related control voltage $V_{24\ V\ safe}$.
- Adhere to the technical data of the BST module and the brake.
- Adhere to the general installation regulations in the "Installation" chapter.

The following figure shows EMC compliant installation.



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4.3 Requirements on external safety controller

A safety relay can be used as an alternative to a safety controller. The following requirements apply analogously.

- The safety controller and all other safety-related subsystems must be approved for at least that safety class which is required in the overall system for the application-related safety function. The following table shows an example of the required safety class of the safety controller.

Application	Safety controller requirements
Category 3 according to EN 954-1	Category 3 according to EN 954-1 Performance level d according to EN ISO 13849-1 SIL 2 according to EN 61508
Performance level d according to EN ISO 13849-1	Performance level d according to EN ISO 13849-1 SIL 2 according to EN 61508

- The wiring of the safety controller must be suitable for the required safety class, (see manufacturer documentation). The safety-related control voltage $V_{24\ V\ safe}$ can be safely disconnected either at the positive, or the positive and negative pole. SEW-EURODRIVE recommends bipolar disconnection.
- The values specified for the safety controller must be strictly adhered to when designing the circuit.
- The switching capacity of the safety relays or the relay outputs of the safety controller must correspond at least to the maximally permitted, limited output current of the safety-relevant control voltage $V_{24\ V\ safe}$. **Observe the manufacturer's instructions concerning the permitted contact loads and fusing that my be required for the safety contacts. If there are no manufacturer's instructions for fusing, the contacts must be protected with 0.6 times the nominal value of the maximum contact rating specified by the manufacturer**.
- To ensure protection against unintended restart in accordance with EN 1037, the safety controllers must be designed and connected in such a way that resetting the control device alone does not lead to a restart. A restart may only be carried out after a manual reset of the safety circuit.
- The input of the safety-relevant control voltage $V_{24\ V\ safe}$ of the safety-relevant BST brake module (terminal 5/6) is equipped with a serial polarity protection diode and a buffer capacitor with C = 6 µF. This must be considered as load when dimensioning the switching output.
- When switching off the BST with tested safe outputs, the switch-off test pulses must not exceed 1 ms. The next pulse blanking cannot reoccur earlier than after 20 ms.

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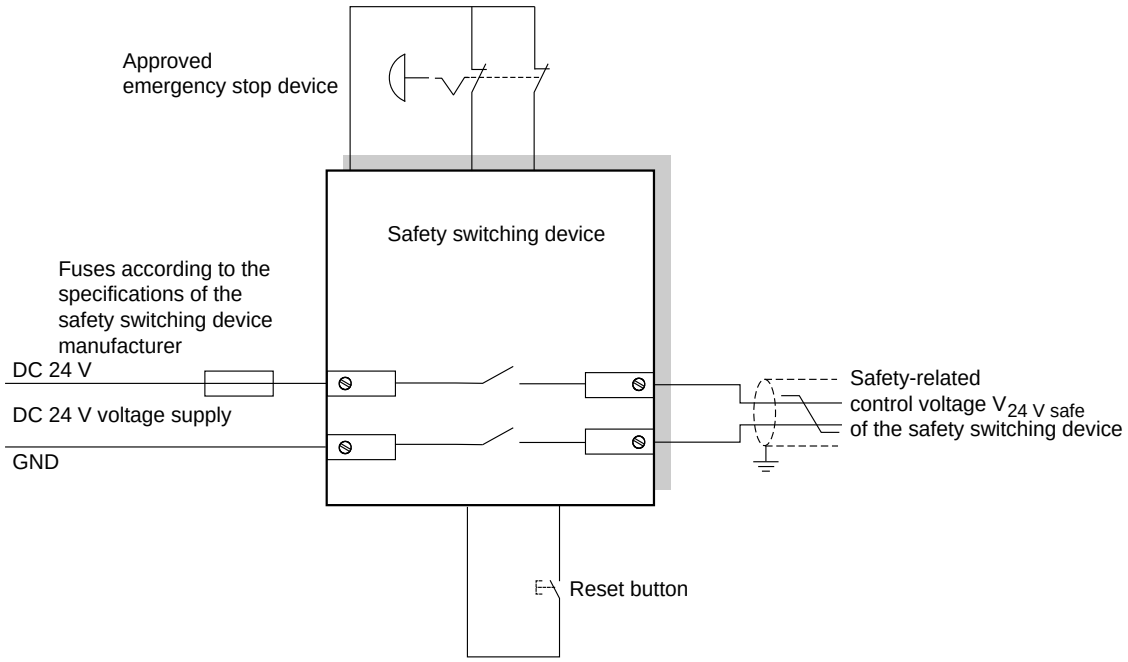
4.3.1 Sample circuit for a "safety switching device"

The following figure shows the basic connection of an external safety switching device (according to the before mentioned requirements).

Observe the information in the respective manufacturer's data sheets for connection.



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4.4 Requirements on startup

- Startup must be documented and the functionality of the safety functions must be demonstrated. Observe the limitations for the safety functions of the BST brake module in chapter "Restrictions" for the verification of the safety functions. Non-safety-relevant parts and components that affect the result of the verification test (e.g. brake rampe of a frequency inverter) must be deactivated, if necessary.
- For using the BST brake module in safety-relevant applications, it is essential that you perform and record startup checks for the disconnecting device and correct wiring.
- During the startup procedure/function test, the correct assignment of the respective voltage supply connection must be checked by means of a measurement.
  - Safety-relevant control voltage $V_{24\ V\ safe}$: Terminal 5/6
  - Functional control voltage $V_{24\ V\ in}$: Terminal 3/4
- The function check must be carried out separately for all potentials.
- Observe the notes in the "Startup" chapter.

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4.5 Requirements on the operation

- Operation is only allowed within the limits specified in the data sheets. This applies to both the external safety relay as well as the BST.
- You must check the safety functions on a regular basis to ensure proper functioning. The the test intervals should be specified in accordance with the risk assessment.
- Also observe the information in the "Inspection/Maintenance" chapter.

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5 Unit Design

5.1 Nameplate, type designation

5.1.1 Example: Type designation

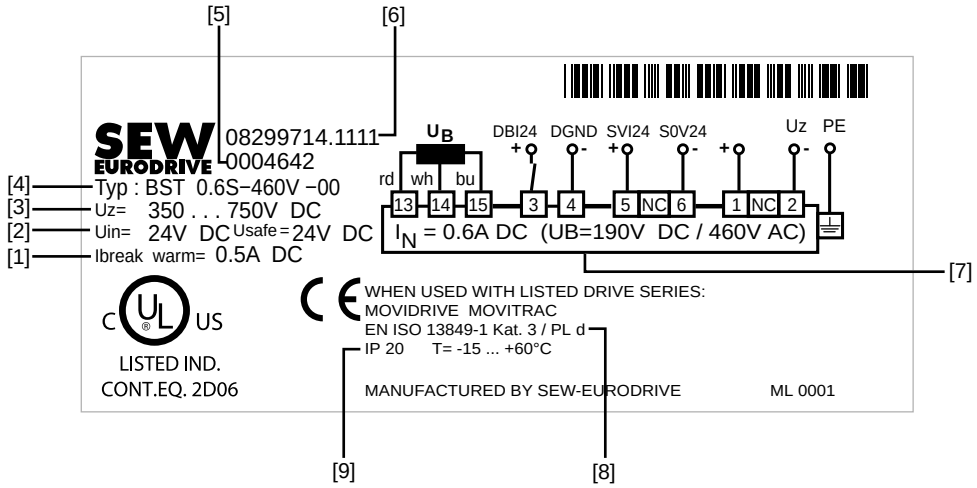
The following characteristic unit data can be read from the type designation:

BST 0.6 S - 460V - 00

Version/type		
Brake voltage	460 V = AC 460 V (DC 190 V) 400 V = AC 400 V (DC 167 V) 230 V = AC 230 V (DC 96 V)	
Design	S = Control cabinet module	
Nominal output current	0.6 = DC 0.6 A 0.7 = DC 0.7 A 1.2 = DC 1.2 A	
Series		

5.1.2 Example: Nameplate

The following figure shows a nameplate of BST 0.6S-460V-00:


[5]
[6]
SEW EURODRIVE
08299714.1111
0004642
[4] Typ : BST 0.6S−460V −00
[3] Uz= 350 . . . 750V DC
[2] Uin= 24V DC Usafe = 24V DC
[1] Ibreak warm= 0.5A DC
UB
DBI24 DGND SVI24 S0V24 Uz PE
rd wh bu
13 14 15 3 4 5 NC 6 1 NC 2
IN = 0.6A DC (UB=190V DC / 460V AC)
[7]
c UL us
LISTED IND.
CONT.EQ. 2D06
WHEN USED WITH LISTED DRIVE SERIES:
MOVIDRIVE MOVITRAC
EN ISO 13849-1 Kat. 3 / PL d
IP 20 T= -15 ... +60°C
MANUFACTURED BY SEW-EURODRIVE ML 0001
[9]
[8]

18014398652394507

[1]	Output current ($I_{brake\ warm}$) in warm condition
[2]	Functional control voltage (V_{in}) and safety-related control voltage (V_{safe})
[3]	DC link voltage ($V_{DC\ link}$)
[4]	Type designation
[5]	Serial number
[6]	Part number
[7]	Nominal output current (I_N) and brake voltage (V_B)
[8]	Safety characteristics
[9]	Degree of protection (IP) and ambient temperature (T)

CE mark to state compliance with European guidelines, such as the Low Voltage Directive.

c UL us LISTED

UL logo to confirm that the component is UL (Underwriters Laboratory) tested, also valid for CSA in conjunction with register number 2D06.

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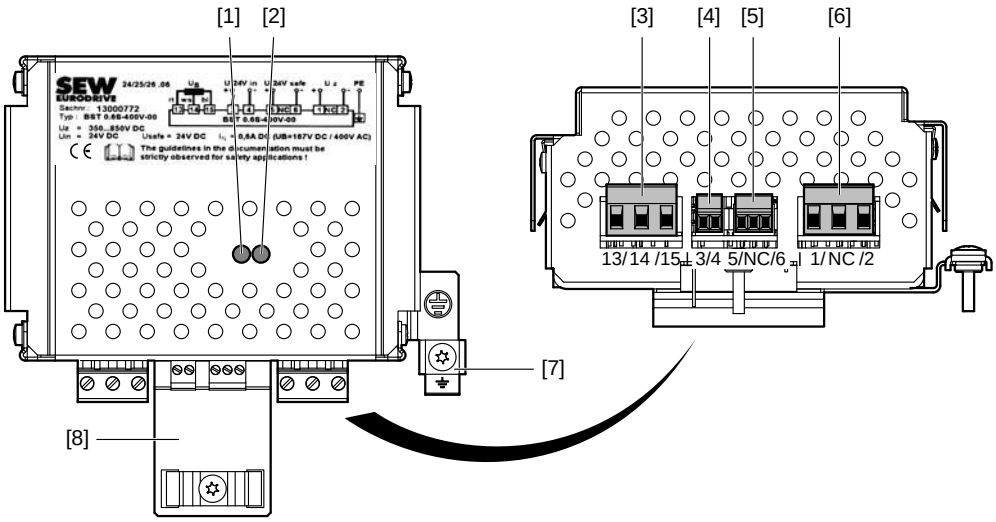
5.2 Scope of delivery of BST

The scope of delivery includes:

- 1 safety-related BST brake module with installed holding fixture for support rail mounting
- 4 attached plug connectors for terminal connections

5.3 Safety-related BST brake module

The following figure shows the unit design of BST x.xS-xxxV-00:



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[1] LED V1 for indicating the operating state
[2] LED V2 for indicating the operating state
[3] Terminals 13/14/15: Brake connection
[4] Terminals 3/4 : For connecting the functional control voltage $V_{24\ V\ in}$
[5] Terminals 5/6 : For connecting the safety-related control voltage $V_{24\ V\ safe}$
[6] Terminals 1/2 : DC link voltage connection $V_{DC\ link}$
[7] PE connection
[8] Retaining plate / shield plate

5.4 Terminal assignment

Terminal		Function
1 **2**	**+U_Z** **- U_Z**	DC link voltage input V_Z
5 **6**	**SVI24** **S0V24**	Safety-related control voltage $V_{24\ V\ safe}$ input Reference potential for safety-related control voltage $V_{24\ V\ safe}$
3 **4**	**DBI24** **DGND**	Functional control voltage input $V_{24\ V\ in}$ Reference potential for functional control voltage $V_{24\ V\ in}$
13 **14** **15**	**RD** **WH** **BU**	Brake output
⏚		Protective grounding

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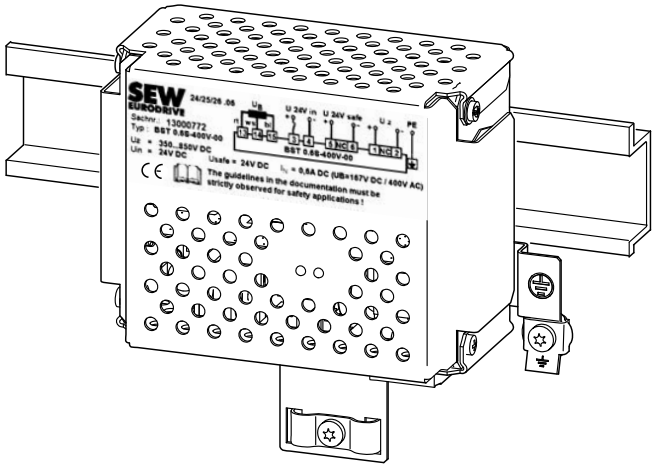
6 Installation

6.1 Mechanical Installation

6.1.1 Support rail mounting

The BST module is mounted onto a support rail in the control cabinet.



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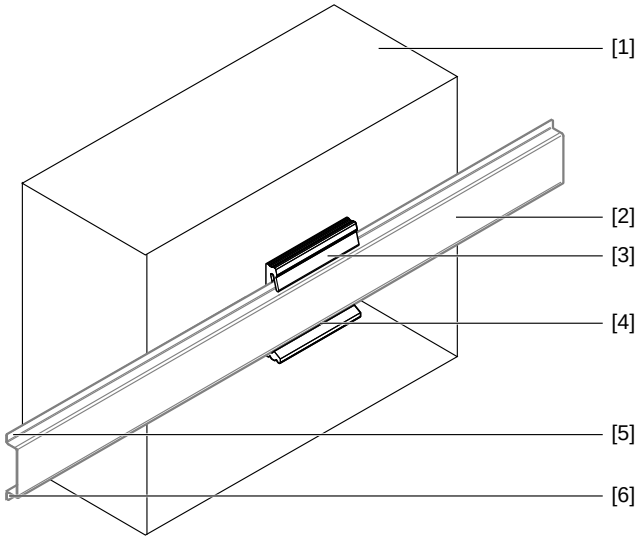
Mounting



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[1] Safety-related BST brake module
[2] Support rail
[3] Upper holding fixture of the BST
[4] Notch, lower holding fixture of the BST
[5] Upper support rail edge
[6] Lower support rail edge

1. The upper holding fixture of the BST [3] is spring-loaded. First, insert the BST into the upper support rail edge [5] with the upper holding fixture only.
2. Next, press the BST downward towards the support rail until the notch [4] clicks into place on the lower support rail edge [6].

   The spring at the upper holding fixture causes the lower support rail edge to be pressed into the notch so that the BST [1] is secured onto the support rail [2].

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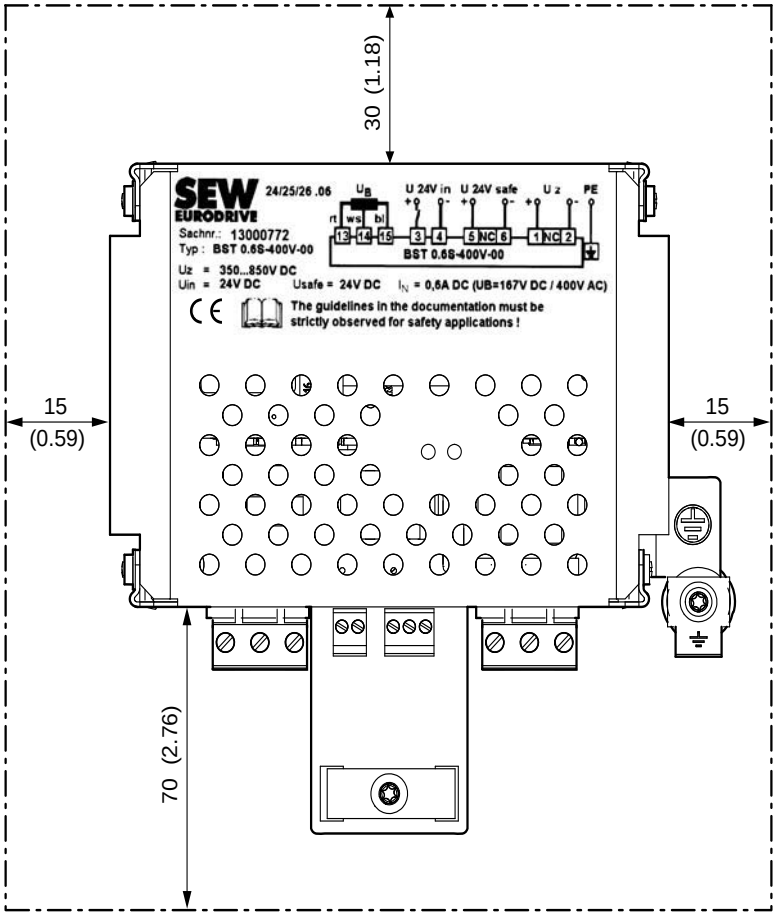
Removal

1. Press onto the BST from the top. This causes the lower support rail edge [6] to come off the notch [4]. At the same time, remove the BST from the lower holding fixture.
2. You can remove the BST from the support rail once the lower lock unfastens.

Minimum clearance and mounting position

- Leave 30 mm clearance at the top, 70 mm at the bottom and 15 mm at the sides for optimum cooling. Make sure air circulation in the clearance is not impaired by cables or other installation equipment.
- Ensure unobstructed cooling air supply and make sure that the units are not subjected to heated air from nearby components.
- Install the units vertically only. Do not install the units horizontally, tilted or upside down.



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All dimensions in mm (in).

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6.2 Electrical Installation

INFORMATION

- The safety-related BST brake module cannot be operated with sine-shaped power regeneration.
- All poles must be disconnected from the supply system when work is carried out on the electrical section of the system. Dangerous voltages may still be present for up to 10 minutes after disconnection from the power supply system.

6.2.1 Information on electrical installation

Supply cable (terminal 1/2)

The supply cable must meet the following conditions:

- The supply cables to the BST carry a high DC voltage (max. DC 970 V). The rated voltage of the cable must amount to at least V_0/V = 300 V / 500 V (in accordance with DIN VDE 0298).
- The inverter supply system must have a grounded star point (TT/TN). The operation is not permitted for IT systems or systems grounded via an outer conductor.
- Cable cross section: 0.75 mm^2 – 2.5 mm^2 (AWG 19 – AWG 13)
- Max. cable length: 100 m (328 ft)
- When several BST are connected to one DC link, the input power of the inverter must be taken into account.
- All poles of the supply cable are protected with two corresponding DC fuses F1/F2 (recommended 1000 V/4 A).

INFORMATION

The fuses may not be required in compliance with IEC 60364-4-43 ((VDE 100 part 430) and EN 60204-1 if the supply cable to the BST is protected by the input fuse located in front of the inverter, or if the following conditions are met:

- The cable length to the BST must not exceed 3 m.
- Do not lay cables in the vicinity of inflammable substances.
- Reduce the risk of short cirucits to a minimum.
- Use the greatest possible cable cross section.

Functional control cable (terminal 3/4)

The functional control cable must meet the following conditions:

- Cable cross section of 0.5 mm^2 – 1.5 mm^2 (AWG 20 – AWG 16)
- Max. cable length: 100 m (328 ft)

Safety-related control cable (terminal 5/6)

The safety-related control cable must meet the following conditions:

- Cable cross section of 0.5 mm^2 – 1.5 mm^2 (AWG 20 – AWG 16)
- Max. cable length: 100 m (328 ft)

Brake cable (terminal 13/14/15)

- Cable cross section of 0.75 mm^2 – 2.5 mm^2 (AWG 19 – AWG 13)
- Max. cable length: 200 m (656 ft)

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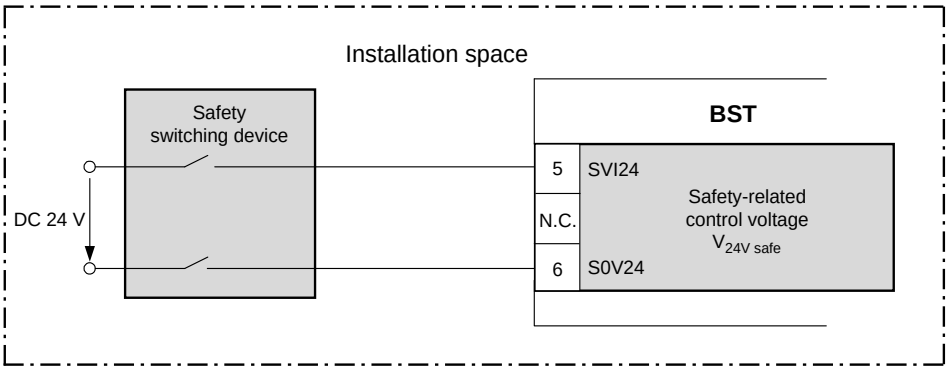
6.2.2 Double-pole safe disconnection

The following figure shows the wiring inside the installation space:



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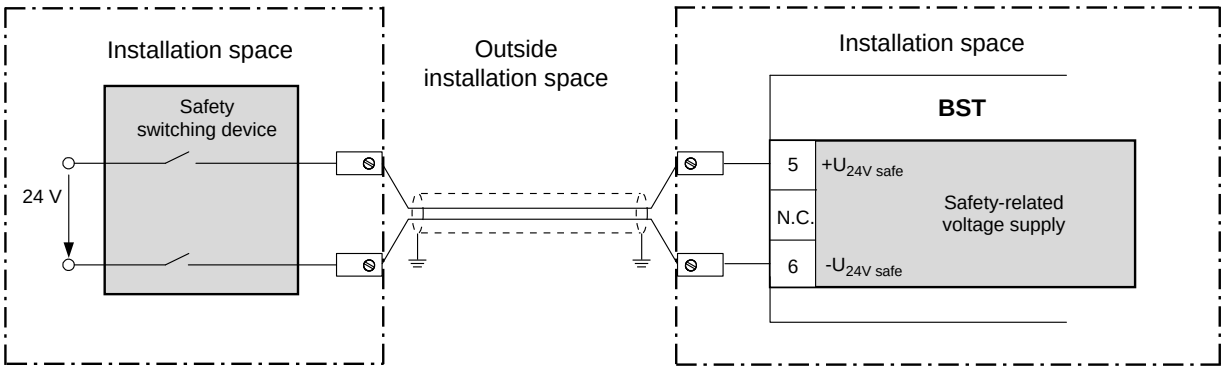
The following figure shows the wiring outside the installation space:



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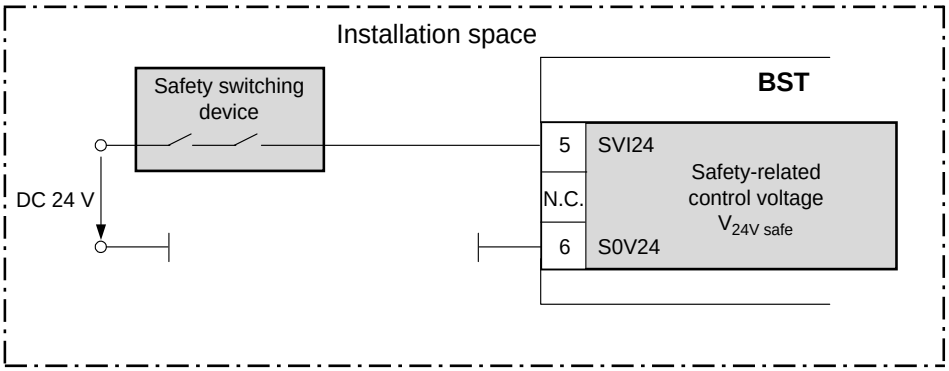
6.2.3 Single-pole safe disconnection

The following figure shows the wiring inside the installation space:



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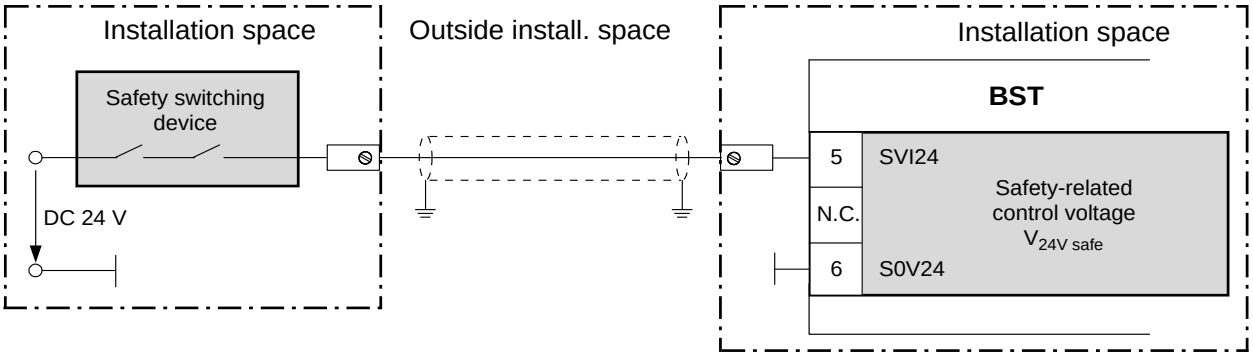
The following figure shows the wiring outside the installation space:



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INFORMATION

Safe single-pole disconnection is only permitted when short circuits in the safety-relevant control cable between safety relay and BST can be ruled out (fault elimination according to EN ISO 13849-2).

SEW-EURODRIVE recommends bipolar disconnection.

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7 Startup

7.1 Operating states

- The brake is activated with the functional control voltage $V_{24\ V\ in}$ when the DC link voltage $V_{DC\ link}$ and the safety-related control voltage $V_{24\ V\ safe}$ are present.

  $V_{24\ V\ in}$ is present ≙ Brake released.

  $V_{24\ V\ in}$ is not present ≙ Brake applied.
- If the safety-related control voltage $V_{24\ V\ safe}$ is disconnected, the brake is safely de-energized (**SBC**).
- If the DC link voltage $V_{DC\ link}$ is disconnected, the brake is de-energized.

The brake is released with high-sped excitation. Rapid brake application (DC and AC switch-off) occurs when it is controlled using the $V_{24\ V\ in}$ functional control voltage or the $V_{24\ V\ safe}$ safety-related control voltage.

The response time for releasing and applying the brake results from the response time of the BST $t_R \leq 6$ ms and the response or application time of the brake connected. For information on response or application times, refer to the applicable operating instructions for motors.

INFORMATION

Fast disconnection (cut-off in the DC circuit) of the brake by the BST module is not part of the safety function (SBC). The brake application time for cut-off in the AC circuit must therefore be used.

NOTICE

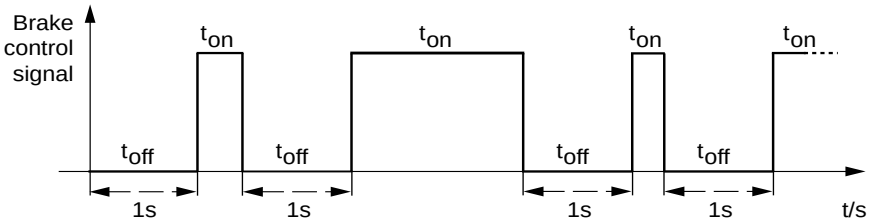
The brake module might be damaged if required off periods are not adhered to.

Damage to the drive system.

- Adhere to the required off periods for the brake module.

7.1.1 Brake module control under normal operating conditions, e.g. automatic operation of the plant

With a brake coil power of P ≥ 70 W, you must ensure a timeout of at least 1 second for brake control.



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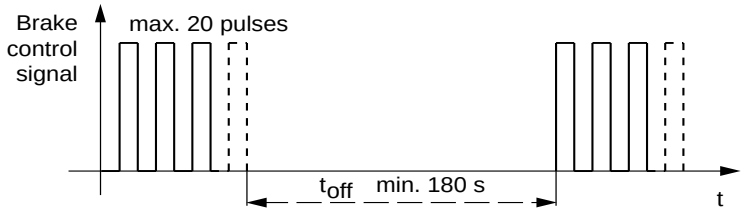
7.1.2 Brake module control under special operating conditions, e.g. teach or jog mode

For teach or jog mode, for example, timeouts shorter than 1 second are possible. After 20 control pulses, a timeout of minimum 3 min is mandatory in this case.



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7.1.3 Operating state display

LEDs V1 and V2 indicate the operating state of the control inputs.

- LED V1: State of the safety-relevant control voltage $V_{24\ V\ safe}$.
- LED V2: State of the brake when the DC link voltage $V_{DC\ link}$ is present.

LED V1	LED V2	$V_{24\ V\ safe}$	$V_{24\ V\ in}$	Operating state
Off	Off	Off	Off	Brake de-energized
Off	Off	Off	On	Brake de-energized
Lights up orange	Off	On	Off	Brake de-energized
Lights up orange	Lights up green	On	On	Brake energized when $V_{DC\ link}$ is present

INFORMATION

- The states of LED V1 and LED V2 must not be regarded as safety-relevant.
- The fact that the LED V1 and LED V2 are no longer illuminated does not indicate that the safety-relevant BST brake module is de-energized and the brake is applied.
- Even if LED V1 and LED V2 are not illuminated, DC link voltage $V_{DC\ link}$ might be present at the BST brake module.

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8 Inspection/Maintenance

⚠ WARNING

Risk of crushing if the hoist falls.

Severe or fatal injuries.

- Secure or lower hoist drives (danger of falling)
- Isolate the inverter, the motor and the brake from the power supply before starting work, safeguarding them against accidental startup.
- Only use genuine spare parts in accordance with the valid parts list.
- Always install a new brake controller at the same time as replacing the brake coil.
- Observe the notes in the operating instructions for AC motors and brakemotors.
- Only qualified personnel may perform maintenance for the brake.

⚠ WARNING

There may still be dangerous voltages inside the unit and at the terminal strips for up to 10 minutes after the BST has been disconnected from the power supply.

Severe or fatal injuries from electric shock.

- Disconnect the BST from the power supply and ensure that the unit cannot be switched on unintentionally.
- Wait for 10 minutes before carrying out any maintenance or inspection work.
- Prior to maintenance or inspection work, make sure that the BST is de-energized.

⚠ CAUTION

The surface of the safety-related BST brake module can be very hot during operation.

Danger of burns.

- Let the BST cool down before you start working on it.

8.1 Inspection and maintenance intervals

The required inspection/maintenance intervals must be calculated by the system manufacturer according to the specific project planning documents for individual applications, in accordance with the regionally valid standards.

8.2 Checking the brake function

The brake function must be checked according to the instructions of the system manufacturer after inspection/maintenance work.

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8.3 Service

Have the following information available when you require assistance from the SEW-EURODRIVE service:

- Nameplate data (complete)
- Type and extent of the problem
- Time the problem occurred and any accompanying circumstances
- Assumed cause

8.4 Unit replacement

Proceed as follows to replace a BST:

- Observe the notes regarding inspection/maintenance work for the BST.
- ⚠ **DANGER** There may still be dangerous voltages inside the unit and at the terminal strips for up to 10 minutes after the BST has been disconnected from the power supply.

  Severe or fatal injuries from electric shock.

  – Disconnect the BST from the power supply and ensure that the unit cannot be switched on unintentionally.

  – Wait for 10 minutes before carrying out any maintenance or inspection work.

  – Prior to maintenance or inspection work, make sure that the BST is de-energized.
- Compare the data on the nameplate of the BST to be replaced with the new one.
- Remove all connecting terminals.
- Disconnect the PE and the shield clamps.
- Push lightly on the opposite side of the connection terminals and remove the BST from the support rail.
- Install the new BST on the support rail. Observe chapter "Mechanical Installation".
- Connect the PE and the shield.
- Connect all connection terminals.

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9 Applications

The following figures show the wiring diagrams for SBC with simultaneous STO (Safe Torque Off).

INFORMATION

- For safe single- and double-pole disconnection, refer to chapter "Electrical Installation"
- DC fuses F1/F2 are not required if the before mentioned requirements for the supply cable are met.
- Observe chapter "Electrical Installation".

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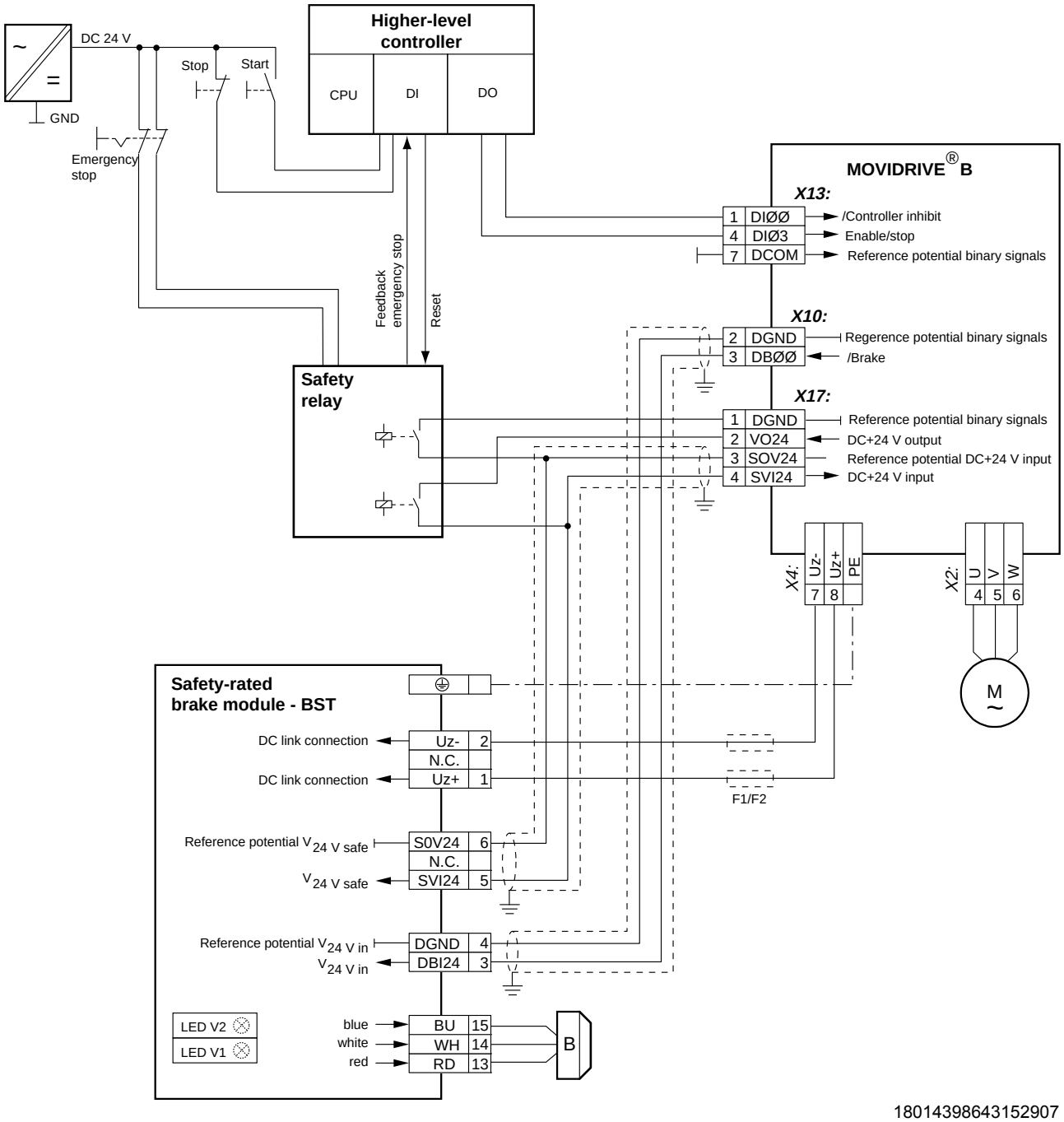
9.1 Disconnection of single drives via inverter (example MOVIDRIVE® B)



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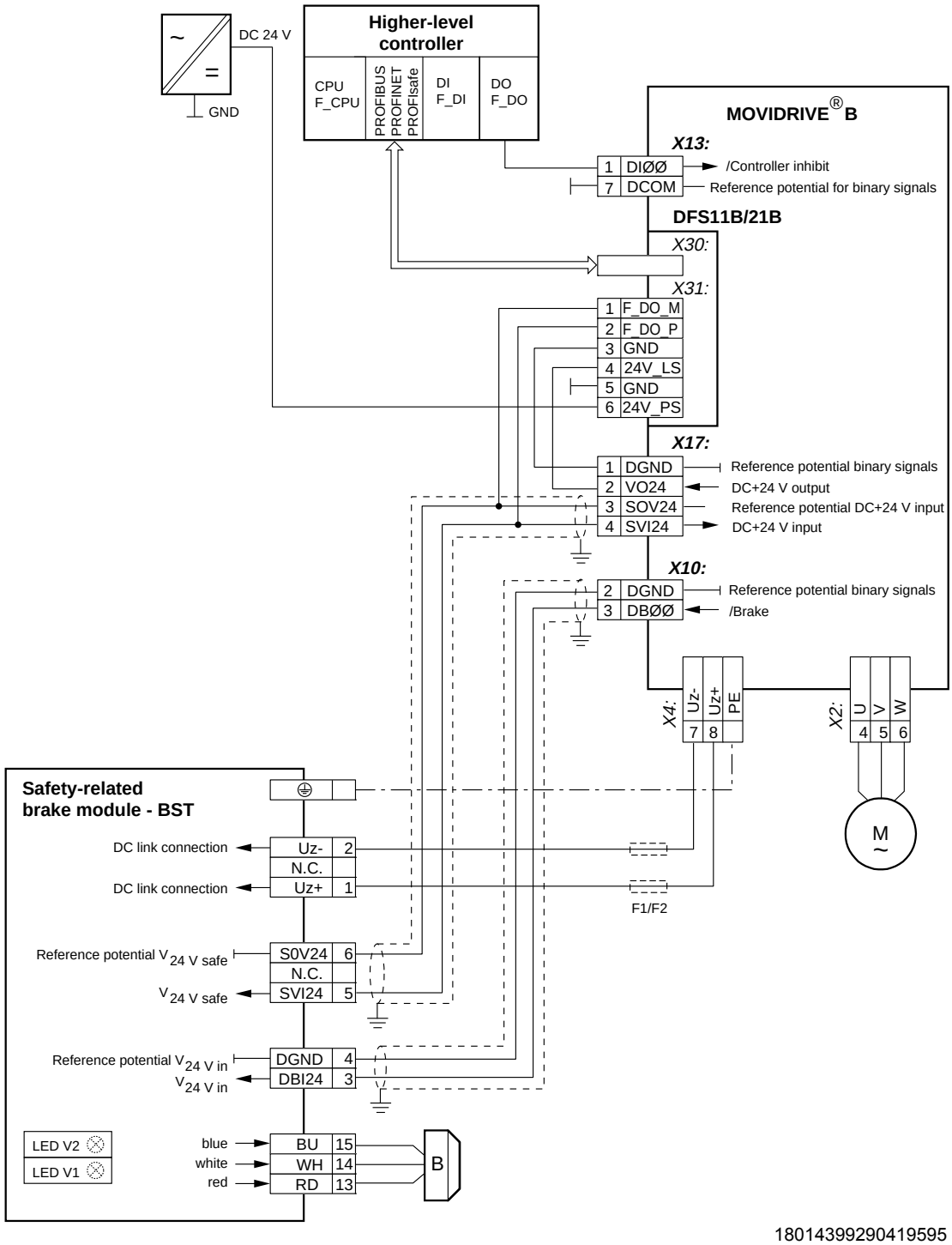
9.2 Disconnection of single drives via inverter and DFS11B/21B fieldbus interface



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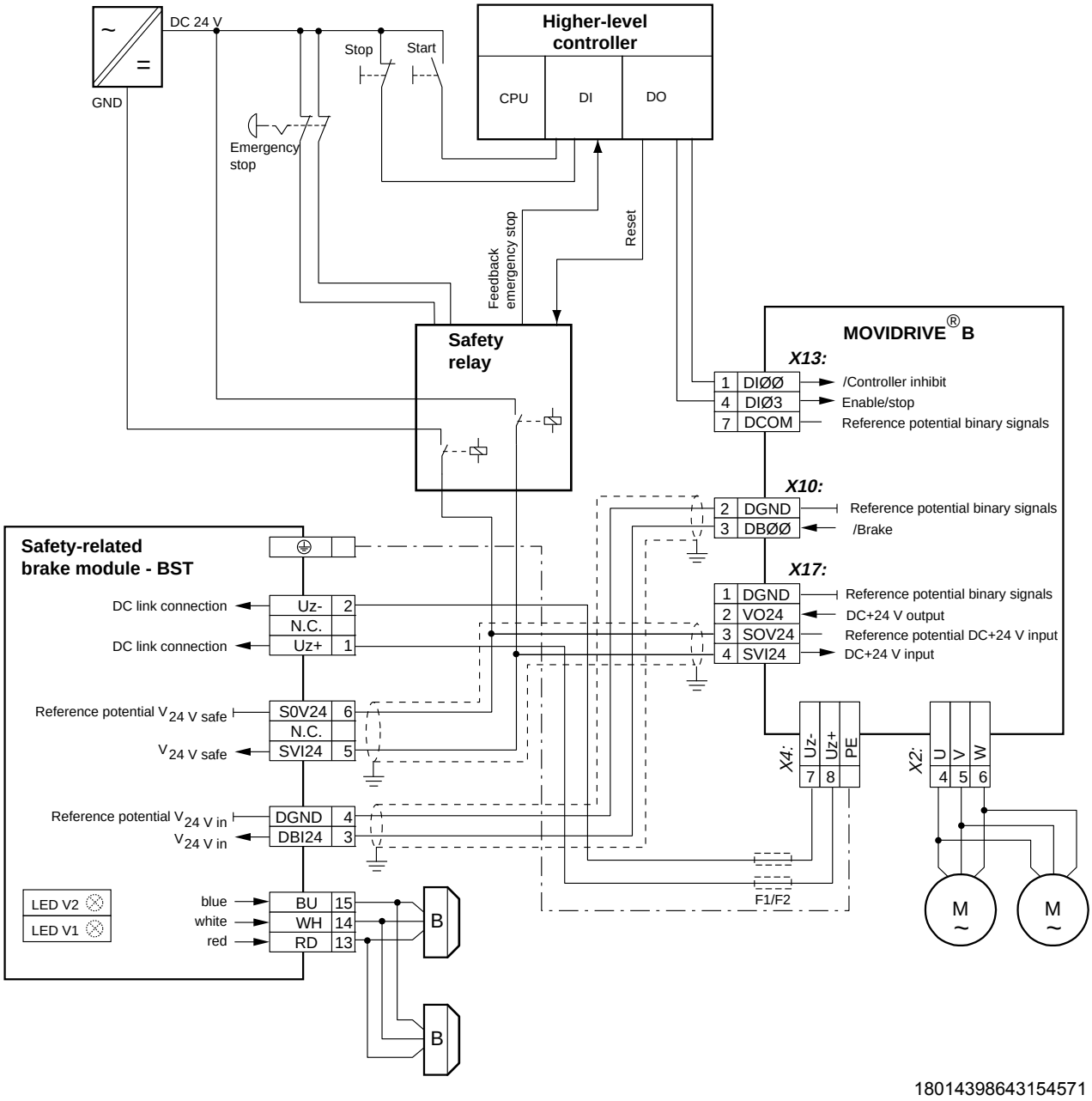
9.3 Disconnection of group drives



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10 Technical Data

10.1 General technical data

Brake module		BST 1.2S-230V-00	BST 0.7S-400V-00	BST 0.6S-460V-00
Part number		1300 1337	1300 0772	0829 9714
Interference immunity		According to EN 61800-3		
Interference emission with EMC-compliant installation		According to EN 61800-3		
Degree of protection		IP20		
Installation		On support rail in control cabinet (control cabinet must have have at least degree of protection IP54)		
Ambient temperature	T_A	−15 °C to +60 °C		
Climate class		EN 60721-3-3, class 3K3		
DC link voltage **Terminal 1/2**	V_Z	DC 350 V – 750 V (briefly up to DC 970 V) (at P_A ≥ 95 W at least DC 450 V)		
Power consumption **Terminal 1/2**	P_E	150 W, depending on brake type Short-term: max. 800 W / 200 ms		
Functional control voltage **Terminal 3/4**	$V_{24\ V\ in}$	Signal level according to DIN EN 61131-2 type 1 DC +15 V to +30 V (> 2mA) => 1 / contact closed DC −3 V to +5 V (< 2 mA) => 0 / contact open You must only use grounded voltage sources with safe disconnection (PELV) according to EN 60204-1 for the control input at terminals 3 and 4.		
Brake voltage **Terminal 13/15**	V_B	DC 96 V	DC 167 V	DC 190 V
AC brake coil voltage		AC 230 V	AC 400 V	AC 460 V
Nominal output current **Terminal 13/15**	I_N	DC 1.2 A	DC 0.7 A	DC 0.6 A
Output current **Terminal 13/15**	$I_{brake\ warm}$	DC 1.0 A	DC 0.6 A	DC 0.5 A
		With P_A = 120 W, the nominal output current reduces in warm condition.		
Acceleration current **Terminal 13/14**	I_B	4 – 8.5 times the holding current depending on the brake type		
Max. output power	P_{out}	P_{out} ≤ 120 W		
Brake output **Terminal 13/14/15**		The figures relate to SEW standard brake coils (two-coil system) Holding coil: Terminal 13_{red} / 15_{blue} Accelerator coil: Terminal 13_{red} / 14_{white} Several brake coils can be connected for redundant systems. The sum of the individual power levels must not exceed the max. output power.		
Disconnection		Cut-off in the DC and AC circuits (rapid application of the brake)		
Supply cable **Terminal 1/2**	V_Z	Rated cable voltage: min. V_0 / V = 300 V / 500 V (to DIN VDE 0298) Cable cross section: 0.75 mm^2 – 2.5 mm^2 (AWG 19 – AWG 13) Max. cable length: 100 m (328 ft)		
Functional control cable **Terminal 3/4**	$V_{24\ V\ in}$	Cable cross section: 0.5 mm^2 – 1.5 mm^2 (AWG 20 – AWG 16) Max. cable length: 100 m (328 ft)		
Brake cable **Terminal 13/14/15**		Cable cross section of 0.75 mm^2 – 2.5 mm^2 (AWG 19 – AWG 13) Max. cable length: 200 m (656 ft) at min. 1.5 mm^2 (AWG 16)		
Power loss	P_V	Max. 30 W		
Storage temperature		−20 °C to +70 °C (EN 60721-3-3, class 3K3)		
Dimensions W × H × D		134 mm × 70 mm × 135 mm (5.28 in × 2.76 in × 5.31 in)		
Weight		About 0.79 kg (1.7 lb)		

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10.2 Safety-related control voltage

The following table shows the technical data for safety-related control voltage $V_{24\ V\ safe}$ at terminals 5/6:

Safety-related control voltage $V_{24\ V\ safe}$	Min.	Typical	Max.
Input voltage range according to DIN EN 61131-2 DC 24 V	DC 20.4 V	DC 24 V	DC 28.8 V
Input current			50 mA
Input capacitance		4.7 µF	6 µF
Switch-on/switch-off threshold		DC 10 V	
Input voltage for OFF state (brake de-energized)			DC 6 V
Duration from switching off the safety-related control voltage at BST until switching off the brake voltage V_B plus the brake application time of the connected brake.[1)]			6 ms
Safety-related control cable			
• **Cable length**			100 m (328 ft)
• **Cable cross section**	0.5 mm^2 (AWG 20)		1.5 mm^2 (AWG 16)

1) The brake application time for cut-off in the AC circuit must be used.

10.3 Safety characteristics of BST brake modules

	Characteristic values to EN ISO 13849-1
Classification/underlying standards	PL d
System structure	Category 3
Probability of dangerous failure per hour (PFH value)	0 (fault exclusion)
Mission time / service life	20 years
Safe condition	Brake de-energized
Safety function	SBC (safe brake control) according to IEC 61800-5-2

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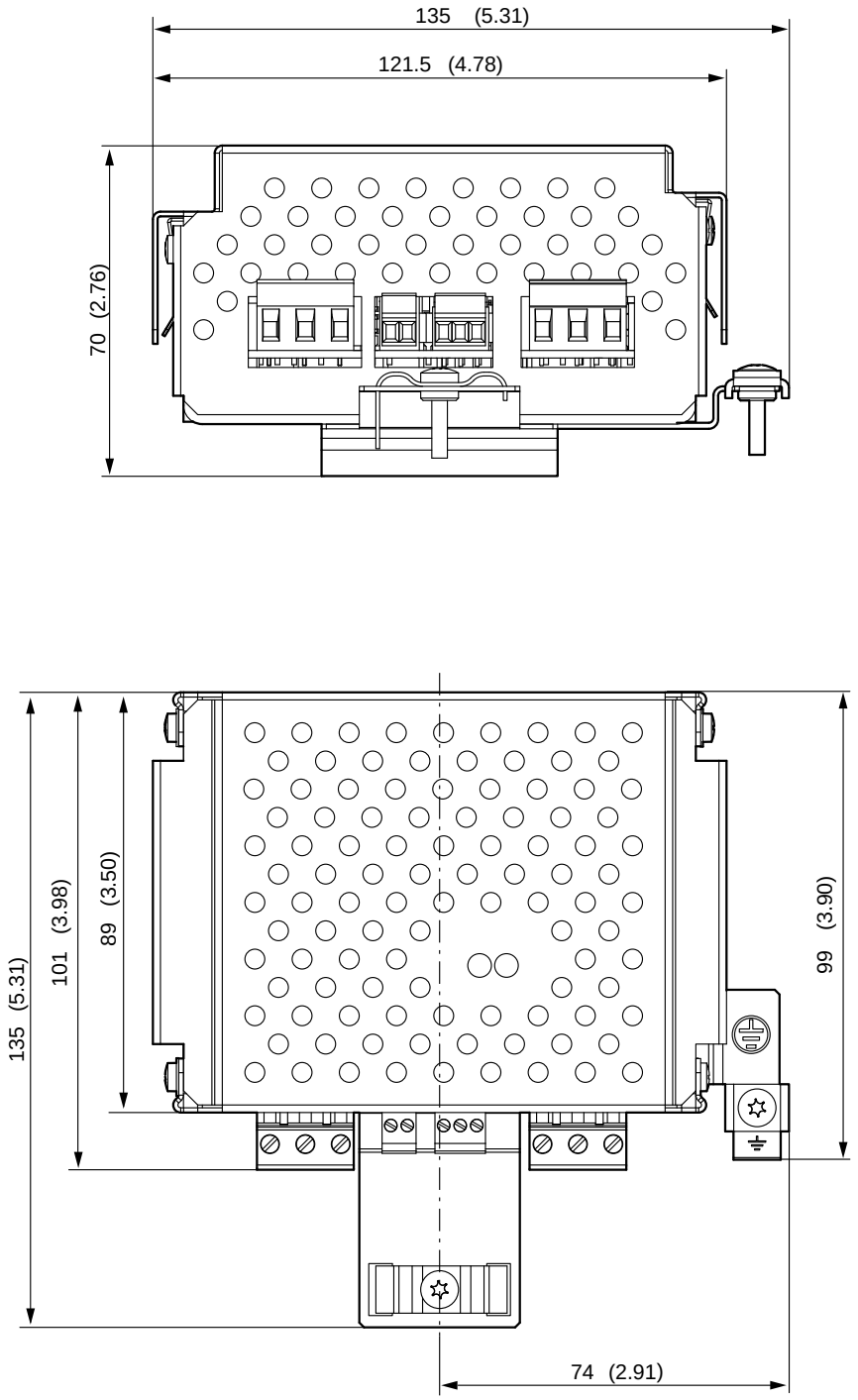
10.4 Dimension drawing of BST in control cabinet design

The following figure shows the dimension drawings of BST in control cabinet design:



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All dimensions in mm (in).

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